GEOLOGY AND PALEONTOLOGY.

The Cuyahoga Shales.—C. L. Herrick has published a paper in which he summarizes his studies of the Cuyahoga shale and the Ohio Waverly as follows:

1. The Berea grit is the natural floor of the series, the Bedford shale having its faunal relations decidedly with the shales of the Devonian below.

2. The Bedford forms a striking exemplification of the doctrine of colonies, and that portion lying to the southwest, beyond the western limits of the Erie, retained a fauna derived from the Hamilton long after this fauna had perished to the eastward.

3. The Cuyahoga shales (including the whole series above the Berea so far as present in the Cuyahoga valley) is divisible into three minor sections, the uppermost of which is characterized by a vast abundance of fossils, which are specially well preserved in calcareous or ferruginous concretions, and is a constant and almost unvarying horizon, extending from Lake Erie to the Ohio River. The Cuyahoga proper is never more than 200 feet thick, and forms a transition zone, with a prevailing Devonian habitus.

4. The upper portion of the Waverly is quite distinct from what precedes in fauna, and contains an undoubtedly Lower Carboniferous assemblage.

5. None of the larger divisions of the Carboniferous of the west are entirely unrepresented in Ohio.

6. The transition is nevertheless so gradual that we have an instructive illustration of the evolution of one age from the preceding, with neither catastrophy nor annihilation.

7. There is an opportunity to trace the geological variations in a species as distributed over a great area, and to observe the evolution of new types therefrom.

8. The entire thickness of the Waverly is not far from 700 feet, though the highest consecutive section measures only 670 feet.

9. The Cuyahoga fauna bears an unmistakable resemblance to the so-called Subcarboniferous of Belgium, especially that of Etage I., the limestone of Fornari.

The Pilot Knob of Texas.—Robt. T. Hill has made a study of Pilot Knob in the vicinity of Austin, Texas, and has reached the following conclusions:

"From its structure it is shown that Pilot Knob is the neck of an

ancient volcano which rose out of and deposited its débris in the deep water of the Upper Cretaceous sea (probably Niobrara sub-epoch). From its isolated position, remote from any contemporaneous shore-line, it must have been an island eruption. Pilot Knob probably belongs to a great chain of igneous localities, eruptive and basaltic, extending from the mountains of Northern Mexico to the Ouachita system of Arkansas, both of which regions abound in related features. The great Balcones system of N. 20° E. faults of Central Texas are later than Upper Cretaceous. In late Cretaceous and Tertiary times Pilot Knob was either totally submerged or greatly denuded." (*Am. Geol.*, Nov., 1890.)

The Sierra Nevada of Central California.—During the past season G. F. Becker has studied the structure of the Sierra Nevada Mts. in the neighborhood of the Stanislaus and Truckee Rivers, with the following results:

The whole area in this region has been glaciated up to the summits of passes. There are six systems of fissures. The fissures are fault planes. The disturbances which caused the fissures happened since the close of the Miocene. The faults rarely exceed three inches. A careful study of the vertical fissures leads to the hypothesis of a horizontal thrust acting on a south-southwest to north-northeast line. Mr. Becker advances arguments to show that no important tilting of this portion of the Sierra has taken place at or since the post-Miocene disturbances. The paper closes with the assertion that the theory that the earth is a solid highly viscous mass, is in all respects compatible with the observations, fully explaining every one of the six fissure systems, the faults observed, and the enormous resistance to tilting which the range has displayed. (Bull. Geol. Soc. Am., Vol. II., pp. 49–74).

The Origin of the Great Lakes.—In discussing the origin of the basins of the great lakes of America, J. W. Spencer concludes that the valleys of Lakes Erie, Huron, and Michigan are the result of erosion of the land surfaces by the ancient St. Lawrence River and its tributaries during a long period of continental elevation, and that meteoric agencies had broadened the valleys. This condition was at its maximum just before the Plistocene period. The closing of portions of the old Laurentian valley into water-basins occurred during and at the close of the Plistocene period, owing, in part, to Drift filling some portions of the original valley, but more especially to different warpings of the earth's crust. (*Quart. Geol. Soc.*, Nov., 1890.)

Age of the Glacial Period.—In discussing the cause of the Glacial period, Mr. Warren Upham discards the astronomic theory, since it seems wholly untenable in view of the geologic evidences that not many thousand of years have passed since the departure of the ice-sheets. The measurements of the gorge and Falls of St. Anthony, the surveys of Niagara Falls, the rates of wave-cutting along the sides of Lake Michigan, the rates of filling of kettle-holes, and the rate of deposition in the Connecticut valley at Northampton, Mass., all indicate that the time since the Glacial period cannot exceed 10,000 years. Mr. Upham cites evidence in proof of the theory that the cause of the Glacial period was great uplifts of the glaciated areas, probably in conjunction with important changes in the course and volume of the warm ocean currents. (*Am. Geol.*, December, 1890.)

Geological News.—General.—In a recent paper Mr. E. W. Claypole replies to the four leading arguments for the permanence of the ocean abysses and the continental masses. While he does not advocate the extreme views of Forbes, he gives many good reasons for not adopting the permanence theory in its entirety (Bull. Geol. Soc. Am., Vol. II., p. 10).——Contrary to the general belief that coral reefs are not formed in the western waters of the Gulf of Mexico, Prof. Heilprin and Frank C. Bahn found thirteen species of corals in the neighborhood of Vera Cruz. There are a number of reefs consisting of detached islands extending eastward from the coast nearly six miles. In some cases the greatest development of coral growth is on the lee or shore side. They belong to the same category as the Florida reefs and banks (Proc. Acad. Nat. Sciences, Phila., 1890, p. 303).——In discussing the phosphates of Redonda, a volcanic island in the Caribbean sea, Prof. C. H. Hitchcock maintains that the enormous quantity of mineral precludes the possibility of its having been derived from the droppings of birds, and suggests that it may have come up from below as a phosphuret, which has since changed its character through oxidation and hydration (Bull. Geol. Soc. Am., Vol. II., p. 6).——According to D'Invilliers, the output of guano from the Island of Nevassa is between sixty and seventy-five tons per day. There are two varieties, the gray and the red; the former is the more valuable, since it contains a less percentage of sesquioxide of iron and alumina (Bull. Geol. Soc. Am., Vol. II., pp. 75–84).

Paleozoic.—Mr. A. Smith Woodward considers *Ctenodus interruptus* the Lower Carboniferous representative of the well-known *C. cristatus* (Rept. Yorkshire Philos. Soc., 1889).——According to

H. S. Williams, the Pennine Range of North England affords a typical section upon which the Carboniferous system was founded; and as the term Carboniferous is a misnomer geologically, since coal-bearing rocks are not confined to the system generally so-called, and as the name does not indicate the geographic position of the typical section, he believes that the adoption of the name Pennian System may be of advantage (Bull. Geol. Mag., Vol. II., p. 16).

Mesozoic.—The dentition and dorsal fin-spines of a shark (*Hybodus delabechei*), from the Lower Lias of Lyme Regis, Dorsetshire, have been described by A. Smith Woodward. This specimen is of special interest since it gives the first information as to the number and proportions of the dental series in the jaw of the typical members of the genus to which it belongs (Yorkshire Philos. Soc., 1888).——Some Triassic plants from New Mexico have been described by Wm. H. Fontaine and F. H. Knowlton. They include *Equisetum abiquiense*, *E. knowltonii*, *Zamites powellii* (*?*), *Z. occidentalis* (*?*), *Cheirolepis munsterii*, *Palissya braunii* (*?*), *P.* cone (*?*), *Cycadites* (*?*), and *Ctenophyllum* (*?*). They were found in the shale of a copper mine, and many of the specimens were not well enough preserved to permit of a positive identification. In the sandstone above the shale was found *Araucarioxylon arizonicum* Knowlton (Proc. U. S. Nat. Mus., Vol. XIII., pp. 281–285, Pl. XXII.–XXVI.)——A. Smith Woodward has described a new Pycnodont fish from the English Portlandian bed, and named it *Mesodon damonii*, in memory of one of the most successful explorers of that formation (*Geol. Mag.*, Decade III., Vol. VII., No. 310, p. 158, April, 1890).——A. Smith Woodward announces the discovery of a Jurassic fish fauna in the Hawksbury beds of New South Wales (*Ann. and Mag. Nat. Hist.*, Nov., 1890).——In a recent paper A. Smith Woodward summarizes the skeletal anatomy of the genera Centrolepis and Oxygnathus, and refers two new fishes from the Lower Lias to Cocolepis and Undina respectively, under the names *C. liassicus* and *M. barroviensis* (*Ann. and Mag. Nat. Hist.*, June, 1890).——A. Smith Woodward has recently elucidated some new points in the skeletal anatomy of the genus Eurycormus. This genus has been placed in the same great group as the existing Amia, and the new osteological facts tend to confirm the accepted determination (*Geol. Mag.*, Decade III., Vol. VII., No. 313, p. 289, July, 1890).——According to A. S. Woodward, the fossil fishes of the English oölites are listed as follows: Selachii, 14; Chimæroidei, 11; Ichthyodorulite, 1; Dipnoi, 1; Ganoidei, 18 (Proc. Geol. Ass., Vol. XI., No. 6).

Cenozoic.—A unique siluroid fish from the London clay of Sheppey has been figured and described by A. Smith Woodward. From the character of the fossil its precise affinities cannot be determined, but it closely approaches the living Auchenoglanis of the African rivers. König's name of *Bucklandium diluvii* has been retained (Proc. London Zool. Soc., 1889).——Mr. L. C. Hicks has been studying the lagoons of Custer county, Nebraska, and reaches the conclusion that they are the result of sedimentation upon a surface previously shaped by the action of the winds. In other words, the lagoon type is a combination of the sedimentary and æolian types of conformation (Bull. Geol. Soc. Am., Vol. II., p. 25).——In a discussion of the Glacial epoch, F. Leveret presents a line of evidence in support of the theory of two distinct epochs. This evidence is based upon the character of the buried soil and leached till of ten moraines in Illinois, Indiana, and Ohio. The amount of oxidation and leaching would require the lapse of a long interval of time; that is, an epoch of deglaciation in the midst of the Glacial period (Proc. Boston Soc. Nat. Hist., Vol. XXIV., 1889).——According to L. C. Johnston, the flood of muddy waters from the Nita crevasse in the Mississippi River has seriously affected the marine life in the Mississippi Sound. Oyster plantings have been destroyed, and many valuable food fishes have been driven out (Bull. Geol. Soc. Am., Vol. II., p. 20).

ZOOLOGY.

Function of Gemmiform Pedicellariæ of Echinoids.[1]—H. Prouho contributes a very interesting observation to the very vexed question of the functions of pedicellariæ. If a specimen of *Strongylocentrotus lividus* or *Sphærechinus granulatus* be placed in a vessel in which there are one or more specimens of *Asterias glacialis* which have been compelled to fast for some time, the Echinoid will be immediately attacked by the starfishes. As soon as it feels the touch of their ambulacral tubes, it rapidly withdraws its spines from the part threatened; the spines bend out from the center of attack to so great an angle that they become almost tangential to the test. In thus removing its spines the urchin unmasks its gemmiform pedicellariæ, which are then stretched towards the arms of the starfish with the jaws

[1] *Comptes Rendus*, CXI., p. 62, 1890. Abstract from *Jour. Roy. Micros. Socy.*, Oct., 1890, p. 611.